Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	}	
	}	
Revision of Part 15 Rules of the Commission's	}	
Rules Regarding Ultra-Wideband	}	ET Docket No. 98-153
Transmission Systems	}	

<u>Reply Comments of Gary R. Olhoeft, PhD</u>

Gary R. Olhoeft, PhD, submits these further reply comments in response to the Notice of Proposed Rule Making (NPRM), FCC 00-163, in the proceeding referenced above. These comments address the most recent submissions provided to the FCC under this docket, including recommendations and conclusions made in submissions by others suggesting continued rule making in this proceeding. Some of those submissions were based upon recent UWB interference test data provided by NTIA, Stanford University, Marshall Space Flight Center, University of Texas-Austin, Johns Hopkins University/Applied Physics Lab and others. Recommendations have been submitted to the FCC by others for either a Rule & Order or Further Notice of Proposed Rule Making (FNPRM) based upon these test data.

With regard to geophysical electromagnetic broadband and ultrawideband (UWB) measurement devices (such as ground penetrating radar, GPR), the test measurements to date are either incomplete or flawed (especially with regard to understanding and testing the normal deployment and use of geophysical equipment), and the resulting conclusions and recommendations reflect those problems. Recommendations such as "the FCC amend Part 15 of the Commission's rules to allow UWB operation only above 3.1 GHz" fly in the face of physical and hydrogeological reality, which require measurements to be performed in the frequency range that electromagnetic energy will penetrate into the earth (anywhere from 0.000001 Hz to over 1,000,000,000 Hz depending upon soil and rock type, temperature, water content and salinity, and requirements of the application problem depth of penetration and resolution).

Recommendations such as "FCC amend part 15 of the Commissions rules to not consider additional mitigating factors when determining permissible emission levels and frequencies for UWB operation" ignore the operational and public health and safety realities of deploying such devices, especially in times of emergency response to earthquake, flood, contaminant release, utility disruption, landslide, avalanche, oil spill, building collapse, terrorist attack, mine rescue, and other manmade and natural disasters. To fulfill these emergency response requirements alone, I could argue (I won't so argue) that there should be no emissions of any sort allowed below 1 GHz that would interfere with geophysical measurements – e.g., no broadcast industry, no garage door openers, no cell phones, no HDTV, no wireless internet and so forth, and that they should all move above 1 GHz. However, that would be patently absurd, and in geophysics we've learned to operate with or around such interferences most of the time. Sometimes (rarely) we do request that all local transmitters be turned off for minutes while we make crucial (especially emergency response) measurements, and people usually understand and comply. This is often akin to turning off all transmitters when passing explosive blasting zones during highway construction.

The biggest error in solving problems using any kind of geophysics involves knowing where the geophysical sensor or measurement device is located during the measurement. To do this requires a lot of precision surveying, including use of real time kinematic differential global positioning systems (RTK DGPS). We are very careful not to interfere with these GPS devices as they are crucial to our own measurement utility. It does absolutely no good to make a measurement and have no idea where it was taken. Most of the commercial GPR (and other geophysical equipment) manufacturers have GPS capability built into or sold with their systems. The bigger problem for us is that the RF communications between pairs of DGPS receivers often interferes with our measurements. Sometimes the fully FCC Part 15 compliant laptop computers that we use to record data interfere with our measurements, requiring special care in the location and use of the computers, or in turning them off.

For your further information, I enclose the following partial list of electromagnetic geophysical public health and safety applications and federal agencies who do them with typical frequencies:

agricultural nonpoint source pollution	USDA, EPA, USGS	0.001 Hz - 1000 MHz
depth of plow and root zone studies	USDA	100 MHz - 1000 MHz
ground water quality and quantity	USDA, USGS, EPA	1 kHz - 1000 MHz
highway and bridge integrity	DOT FHwyA	0.01 Hz - 1500 MHz
railroad roadbed integrity	DOD, DOT	400 MHz - 1000 MHz
airport runway & taxiway integrity	FAA, DOD/AF/Navy	500 MHz - 1500 MHz
utility detection, pipeline inspection	NTSB, DOE, WAPA	0.01 Hz - 1000 MHz
power transmission assessment	DOE, WAPA	100 MHz - 900 MHz
leaking underground storage tanks	EPA, DOE	1 kHz - 900 MHz
coal mine safety & subsidence	DOI/OSM	1000 Hz - 500 MHz
earthquake hazards	DOI/USGS	0.0001 Hz - 900 MHz
volcanic hazards	DOI/USGS	0.0001 Hz - 500 MHz
landslide hazards	DOI/USGS	1 kHz - 500 MHz
dam safety	DOI/BuRec	100 MHz - 1000 MHz
dike and levee safety	DOD/USArmy CE	100 MHz - 1000 MHz
collapsed building response	FEMA	100 MHz - 1000 MHz
forensics and anti-terrorist	DOJ/FBI	100 MHz - 1000 MHz
acid mine environmental assessment	EPA, DOI/USGS	0.001 Hz - 900 MHz
avalanche victim recovery	DOI/NPS, USDA/FS	100 MHz - 900 MHz
humanitarian demining activities	DOD	1 kHz - 1000 MHz
unexploded ordnance detection	DOD/Army/Navy	1 kHz - 1000 MHz
nonproliferation investigations	DOD, DOE	1 kHz - 1000 MHz
nuclear power plant safety	NRC, DOE	500 MHz - 1500 MHz
environmental contaminant tracking	EPA, DOI/USGS	0.001 Hz - 900 MHz
critical infrastructure characterization	DOE, DOI, DOD	0.01 Hz - 1000 MHz
radio transmitter siting soil mapping	FCC, DOD, USCG	9 kHz and up

and there are many more (not to mention commercial and scientific applications).

I'm recommending that any changes to the Part 15 Rules under which most electromagnetic geophysics currently operates take into account the frequency ranges required to successfully solve problems (below 1 GHz) as well as the deployment issues in using the equipment (in hazardous and emergency response conditions in particular) or that electromagnetic geophysics be exempt from these rules and subject to a different set of operational requirements. We can live with restrictions such as PRF (pulse repetition frequency) below 1 MHz, but not with "allow UWB operation only above 3.1 GHz". None of the testing to date has tested the geophysical equipment in modes as it would normally be deployed in realistic interference scenarios (nor even a fraction of the deployment scenarios), nor has it tested the reverse interference of other devices on the geophysical equipment (it would be nice to know what needs to be turned off to prevent GPR from locating an avalanche or building collapse victim – we often have to guess, which delays recovery).

The public health and safety arguments alone should be persuasive, including preventing un-needed utility damage from construction activities such as trenching and horizontal drilling (which can be range from the merely inconvenient when a fiber optic line is cut to the spectacular and expensive in life and dollars when natural gas or petroleum pipelines are broken). One of the biggest problems in preventing such construction damage today is the optimum frequencies for locating nonmetallic fiber optic cables and plastic natural gas pipelines are 300 to 900 MHz, which are being severely impacted by interference from the new HDTV and wireless broadband internet. Despite the extensive list of applications noted above, there are very few of us (few thousand) who do these things, and my specific request is that we be involved in the continuing and evolving discussions of rule making so we are not wiped out as an unintended consequence of something proposed to protect another industry from interference. Though there are few of us, what we do impacts the health and safety of lives of billions of people around the world. I haven't even addressed applications such as archaeology, planetary exploration, geotechnical construction assessment, ground water exploration, minerals exploration, oil exploration, and so forth. Without the historical economic incentives of these latter application's exploration needs driving the development of the geophysical methods, the tools wouldn't exist for the health and safety applications noted earlier. Because they have not been needed very often in the past, the economic incentives to develop them and have the expertise available for most health and safety problems alone are virtually nonexistent. However, the current infrastructure characterization and utility detection problems are rapidly changing those economics and regulatory requirements.

Respectfully submitted,

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